*Project S E.N.S.O.R. News

Volume 26 No. 1 Winter 2014-2015

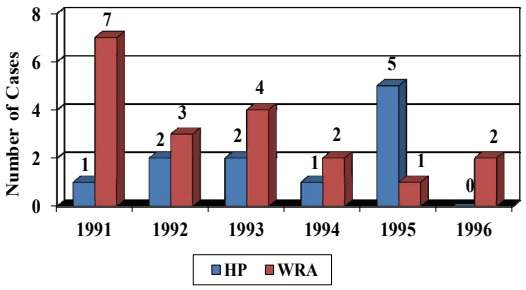
Metal Working Fluids and Lung Disease

Cases of respiratory disease caused by exposure to metal working fluids (MWFs) peaked in the 1990's after hypersensitivity pneumonitis (HP) from exposure to MWFs was first described in workers from an auto parts manufacturer in Southfield, Michigan (1). Subsequent to that initial report, multiple outbreaks of HP were described in other auto parts facilities in Michigan, Ohio and Wisconsin, and then in England and France (2-4). During these outbreaks of HP, cases of work-related asthma (WRA) were also identified. Figure 1 shows the distribution of cases of both HP and WRA recognized at a single facility in Michigan from 1991-1996.

Since 1988 there have been a total of 319 cases of WRA caused by exposure to MWFs reported in Michigan. Most cases were reported in the 1990's and early 2000's.

For 1988 through 2013 inclusive, MWFs were the 3rd most common cause (9.8%) of WRA in the state (Figure 2). However, there has been a marked decline over this time period in the number of reported

Figure 1. Cases of HP and WRA from MWFs at a Single Michigan Company, 1991-1996



WHAT ARE METAL WORKING FLUIDS?

Metal working fluids are liquids used to reduce heat and friction and remove small metal particles during the machining (i.e. cutting, drilling, grinding and milling) of metal parts. Metal machining is a common activity in the manufacture of automotive and truck parts, as well as other types of machinery.

CASE REPORT

A male in his 30's developed wheezing, a productive cough, chest tightness and shortness of breath one year after beginning to operate a grinding machine at an auto parts manufacturer. His symptoms improved when he was away from work, particularly on vacations. He was prescribed Advair and ProAir. He had never smoked cigarettes and had no personal or family history of allergies. He continued to be exposed to a soy-based MWF. During a Michigan OSHA inspection of the facility, half of the workers doing machining were bothered at work by daily or weekly shortness of breath, chest tightness or wheezing. The air levels for MWFs were within the Michigan OSHA permissible exposure limit. OSHA made recommendations to improve ventilation and provide regular medical screening, given the high percentage of symptomatic workers.

WRA cases caused by MWFs. We now receive two to four case reports a year, compared to 10-20 reports received each year from 1990-2005, with a peak of 32 in 1992 (Figure 2). WRA caused by MWFs now represents about 5% vs. over 10% of reports received from 1990-2005 (Figure 3). The decrease in WRA cases from MWFs is steeper than the decline in the overall number of WRA cases reported during this same time period (88% vs. 57%).

This decline in reports received in Michigan parallels the decrease in reports in the medical literature of HP from MWFs (5) and the decrease in WRA cases reported to the Shield surveillance system in the English West Midlands (6).

What is the reason for the decrease in reports of WRA and HP from exposure to MWFs? No changes have been made in the allowable OSHA air standard of 5 mg/m^3, which dates back to 1972, although in 1998 NIOSH recommended the standard be decreased to 0.5 mg/m^3. The 5 mg/m^3 level was not selected for health reasons but because at levels above 5 mg/m^3 MWFs in the air create unsafe work conditions when the fluids condense on factory ceilings, dripping down on work stations and factory floors. Although OSHA did not promulgate a new standard, in 1999 OSHA developed a best practices guide for using metal working fluids (7). The feasibility of retrofitting older equipment and reducing exposure has been demonstrated and most companies are reported to be using the 0.5 mg/m^3 level after purchasing new equipment and a 1.0 mg/m^3 level as their standard for older equipment (8). There has also been increased awareness about work practices and proper maintenance of MWFs. We presume that better control of exposure has been important in reducing the occurrence of respiratory disease among individuals working with metal working fluids, because the use of MWFs remains widespread.

Causal Mechanism of MWF-related Lung Disease

- **Work-Related Asthma** – Sensitization to the fluid or additives
- **Hypersensitivity Pneumonitis** – Immunological reaction to a microbiological contaminant

Figure 2. WRA Caused by MWF Exposure: Michigan 1988-2013

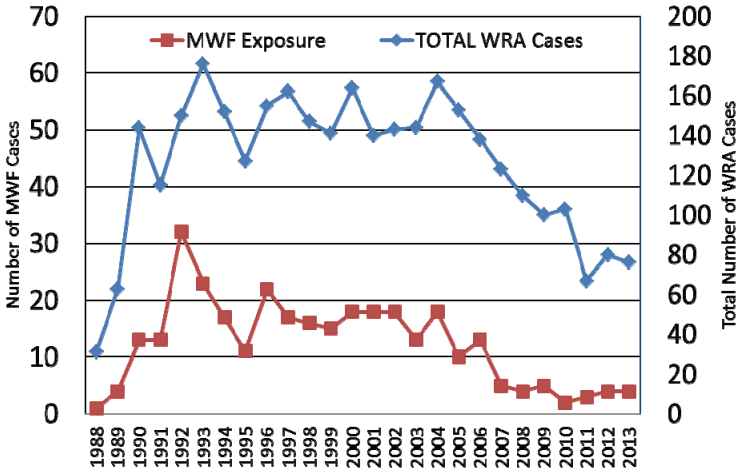
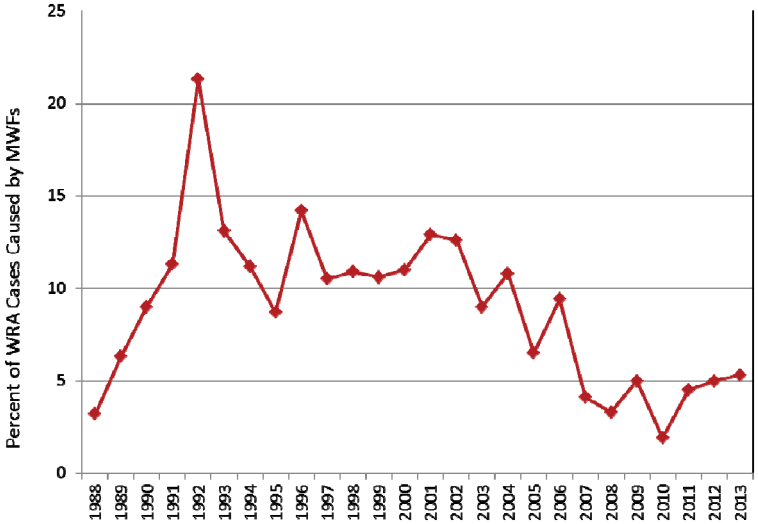


Figure 3. Percent of Work-Related Asthma Caused by MWFs: Michigan 1988-2013



Common Names Used for Metal Working Fluids

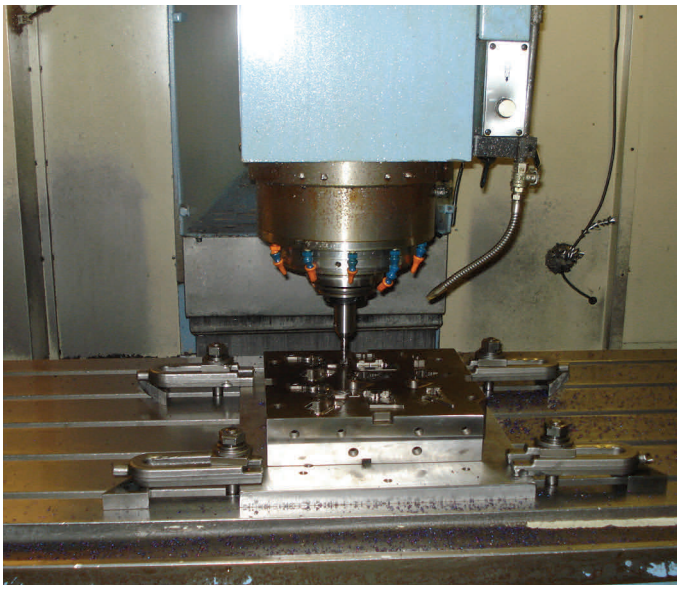
- ✓ Coolants
- ✓ Cutting compounds, oils, or fluids
- ✓ Lubricants
- ✓ Metal removal fluids

During forging and stamping processes, drawing or stamping compounds, which can have similar ingredients as MWFs, are used.

TYPES OF METAL WORKING FLUIDS:

- ✓ **Straight, neat, natural—** petroleum-based oil although vegetable-based oils (corn and soy) have been introduced
- ✓ **Emulsified—** mixture of oil and water
- ✓ **Semi-synthetic—**less oil than emulsified
- ✓ **Synthetic—** no oil

The emulsified, semi synthetic and synthetic MWFs are water-based, and multiple additives can be found in these types of MWFs including: corrosive inhibitors, dyes, and biocides. Microbiologic growth is common in the water-based MWFs and regular maintenance is required to limit microbiologic growth.



This picture shows metal being machined to manufacture a mold to be used in plastic injection. MWFs were sprayed on the metal being machined. The MWF runoff and metal shavings were collected in a large container located under the machine.

We encourage practitioners who have patients with hypersensitivity pneumonitis or asthma and work in manufacturing facilities to consider metal working fluids as the potential causal agent. We are very interested in hearing from you if you have a known or suspected case. Please report via fax, email, our website or by calling Kenneth Rosenman, MD at 1-800-446-7805. Dr. Rosenman can also provide consultation on diagnosis and treatment issues.

References

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5) Burton CM, Crook B, Scaife H, Evans GS and Barber CM. Systematic review of respiratory outbreaks associated with exposure to water-based metalworking fluids. Ann Occup Hyg 2012; 56:374-388.

6) http://www.occupationalasthma.com/occupational_asthma_pageview.aspx?id=493

7) Metalworking Fluids: Safety and Health Best Practices Manual. OSHA, 1999 https://www.osha.gov/SLTC/metalworkingfluids/metalworkingfluids_manual.html

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*PS *Remember to report all cases of occupational disease!*

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Michigan Law Requires the Reporting of Known or Suspected Occupational Diseases

Reporting can be done by:

Web
www.oem.msu.edu

E-Mail
ODREPORT@ht.msu.edu

FAX
(517) 432-3606

Telephone
1-800-446-7805

Mail
Michigan Occupational Safety & Health Administration (MIOSHA)
Management and Technical Services Division
P.O. Box 30649
Lansing, MI 48909-8149

Reporting forms can be obtained by calling (517) 322-1817
Or
1-800-446-7805

The Project SENSOR News is published quarterly by Michigan State University-College of Human Medicine with funding from the National Institute for Occupational Safety and Health and is available at no cost. Suggestions and comments are welcome.

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